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used for cutting towards one, as are adzes with us, and some of them to have been so shaped as to have been peculiarly well adapted for cutting in the living rock for the purpose of detaching a mass of it for particular purposes, or for giving a shape prior to the article being detached.

Evans in his Ancient Stone Implements describes hatchets, or broadaxes, like a certain class of tools found at Cissbury, in England, in certain pits in the chalk, that resemble our soapstone quarry tools in several particulars. Whilst Evans seems inclined, judging from the shapes of these tools, to attribute them to the Neolithic age, it is only, as he says, because of finding associated with them one or two ground celts that they were not considered Palæolithic. Judging from our present quarry experience, these tools, whilst so ancient in shape, appear to be among the most recent of the tools used during the stone age, which almost staggers one's belief in palæolithic forms. It is very often most difficult to describe stone implements, and I have seen but few palæoliths, and therefore may be mistaken, but there is no doubt in my mind that implements identically similar in shape and material with cave or river-drift implements, are to be found on the surface and associated with polished articles of apparent recent date, and nowhere is this more strikingly illustrated than in the immediate vicinity of Washington city. These stones bear the same characteristics which we observe in implements found under circumstances denoting a great age, but are in localities which lead us to consider them as modern.

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ANNELID MESSMATES WITH A CORAL.

BY J. WALTER FEWKES.

THE occurrence of annelid tubes on the under surface of many specimens of the well-known coral, *Mycedium fragile* Dana, from several localities, led me to suspect that the relationship of the worms which inhabit them to the coral, was that of commensals. Similar instances have been described in other genera by those authors who have mentioned the coral galls. A fact which adds to the interest attached to this subject is, that in almost all cases where the annelid is found associated with the coral, it has modified the general shape of the Mycedium to which it is attached. The young of *M. fragile* is a simple fungia-like[1] coral attached at its base, somewhat cup-shaped, with smooth outer walls. As it grows older new individuals form as buds upon the upper part of the disk in circles about the original and centrally placed polyp.

These buds differ somewhat from the parent, and as in the branching Madrepore, *Madrepora cervicornis*, we have two kinds of individuals, a single large—the original polyp—and several smaller found below it on the sides of the branch; so in the saucer-shaped colonies of Mycedium there are, as is best seen in smaller colonies, an original polyp, found in the center of the disk on its upper side, and smaller, or buds from the same, which are arranged in regular concentric circles about it. The smooth under side of the Mycedium is destitute of coral individuals, and is generally covered with Bryozoa, small mollusks and worms; of the latter one of the most interesting is the tubicolous annelid which is claimed as a messmate of the coral, and is thought of more importance than the rest in the determination of the ultimate form of the growing coral community.

The calcareous tube in which the worm lives is firmly united throughout most of its length to the under side of the coral. Its terminal opening in a Mycedium of regular shape, lies near the rim of the saucer-like disk of the young coral. In the growth of the rim this extremity of the worm tube is imprisoned by the increasing edge of the disk in such a way that it is wholly surrounded by the live coral in the progress of its growth. The growth of the worm tube, however, keeps pace with the advance of the coral about it, and as it rises above the upper surface of the Mycedium the opening into the tube is kept uncovered by this growth, so that the head of the annelid with its crown of branchiæ can always have free communication with the outside water, notwithstanding the tube itself is often wholly enclosed in the calcareous secretions of the polyps. When the growing coral covers the terminal opening of the worm-tube the worm dies, but this rarely occurs, as the closing of the opening is generally prevented by a corresponding growth of the tube. In several specimens examined the extremity of the tube had grown in a direction at right angles to the upper surface of the coral and projects a full half inch above that plane. The coral, however, has formed "*æquo pede*" along the sides of this projection and has covered it to the very apex. The result is the formation of variations in the regular growth of the coral which may be likened to a coral-gall such as is formed by the crustacean genera, Hapalocarcinus, Cryptochirus and others. The greater part of the worm-tube lies in sight on the under side of the Mycedium, while its terminal opening is almost wholly concealed, being surrounded by the live coral community through which there is, however, a small opening into the tube cavity inhabited by the worm.

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[1] The resemblance is closer to the attached young ("Strobila") of Fungia than to the free adult.

It is interesting to notice, however, that the modifications in form of the growing Mycedium always begin on its rim in the vicinity of the tube opening. As the growth of the coral goes on, the portion of the cœnosarc on the edge of the saucer-like disk coalesces around the obstruction caused by the tube in such a manner as eventually to completely surround it. When this has taken place the end of the worm-tube grows upward and seems to rise out of the midst of the growing coral. In all cases, however, the shape of the coral is changed by the obstruction to its otherwise regular growth.

In Porites and several other genera we have a similar commensalism of annelids and corals. Specimens of *P. astrœoides* in which these worm-tubes can be well seen, is found in almost every collection of corals. Many specimens have the interior of the coral mass riddled with these worm-cases, whose openings cover the surface of the coral "head." Such a combination of growing coral and annelids, when both are alive, presents one of the most beautiful sights upon a live coral bank.

While younger specimens of Mycedium, almost without exception, have a regular disk-like shape, which in older and larger colonies where the annelid is not found, is still preserved, it almost always happens that the presence of the worm-tube leads to irregularity in form in the animal upon which it is found. Younger specimens are especially well adapted for a study of this phenomenon. Mycedium grows to the level of low water, and is often exposed to the air by very low tides. It is, however, quite hardy, and the short exposures are by no means always fatal. It prefers for its home sheltered lagoons to the open reefs beaten by the surf, which would soon destroy its fragile disk. Its favorite habitat is the side of submarine cliffs and caves.